



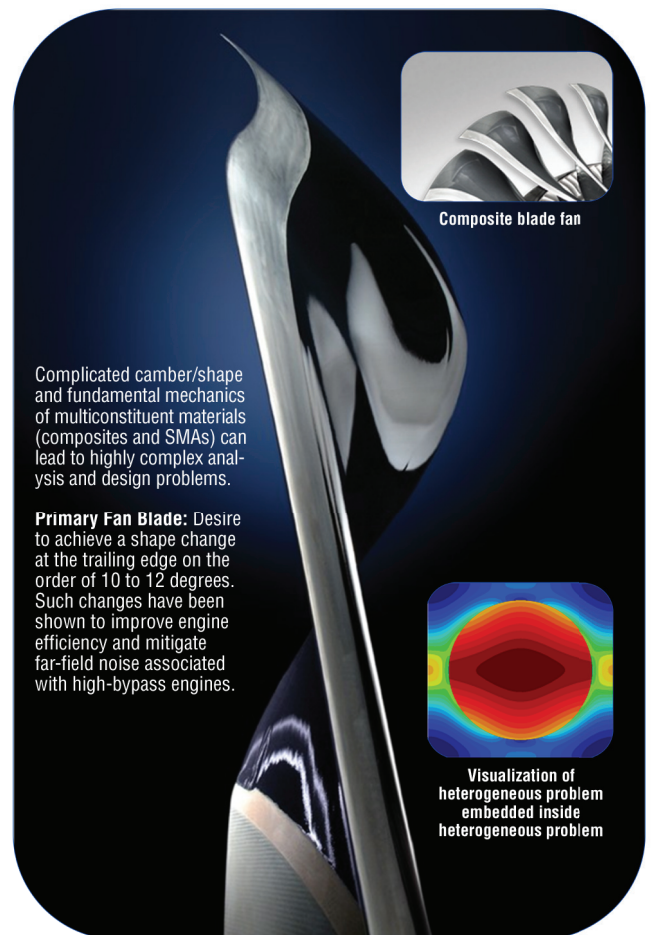
## Shape Memory Alloys

### TECHNOLOGY OPPORTUNITY

NASA's Glenn Research Center invites companies to establish partnerships to investigate potential applications for Shape Memory Alloys (SMAs). SMAs are materials that can be deformed at low temperature and recover their original shape upon heating. Glenn Research Center has been working to develop new alloys that can operate up to  $\sim 300^{\circ}\text{C}$ , compared to  $\sim 80^{\circ}\text{C}$  of commercially available alloys. In addition, NASA has been working on supporting technologies (modeling tools, design methodologies, test standards, material supply chain, etc.) that will promote the application of shape memory alloys for adaptive structures and actuators.

### BENEFITS

- Provide high force (per volume/weight) allowing lightweight compact actuator designs
- Eliminates extraneous systems (hydraulic, pneumatic, etc.)
- Passive control (responds to temperature change), which eliminates the need for sensors and electronics
- Simple frictionless designs result in less maintenance



## TECHNOLOGY DETAILS

SMA's are alloys that have memory. The materials are deformed at low temperature and recover to their original shape upon heating. Applications of SMA's have been limited due to their low transformation temperatures. Glenn has been working to develop new high transformation temperature SMA's and as a result has developed a suite of high work output SMA's as well as design application tools and expertise.

## HOW IT WORKS

SMA's can be used in passive, active, or superelastic design applications. Passive design applications result from the material heating during normal operation resulting in an actuation force. Active design applications use the material below its transformation temperature and use of supplemental heat to provide an "on-demand" actuation force. Superelastic design applications use the material above its transformation temperature and transforms due to stress.



## WHY IT IS BETTER

SMA's are ideal for high force, large stroke, and modest frequency response operations. One example application currently being developed has an SMA to replace a traditional motor/gearbox actuation system at significant weight savings (41:1).



## PATENTS

LEW-16685-1, U.S. Patent No. 6,151,897

LEW-16685-2, U.S. Patent No. 6,367,250

LEW-18054-1, U.S. Patent No. 7,501,032

## LICENSING AND PARTNERING OPPORTUNITIES

Glenn's Office of Technology Partnerships and Planning seeks to transfer technology to and from NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the Shape Memory Alloys.

## FOR MORE INFORMATION

For more information about this and other technology licensing opportunities, please contact

Office of Technology Partnerships and Planning  
NASA Glenn Research Center

Email: [otpp@grc.nasa.gov](mailto:otpp@grc.nasa.gov)

Phone: 216-433-9701